

abstract

Efficacy of Scalp Cooling in Prevention of Chemotherapy-induced Alopecia in Children with Acute Lymphoblastic Leukemia: A Non-randomized Trial with Ultrasonographic and Electron Microscopic Correlation

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Efficacy of Scalp Cooling in Prevention of Chemotherapy-induced Alopecia in Children with Acute Lymphoblastic Leukemia: A Non-randomized Trial with Ultrasonographic and Electron Microscopic Correlation

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Introduction: Chemotherapy-induced alopecia (CIA) is a common adverse event in children undergoing chemotherapy. Scalp cooling (SC), although effective in adults in preventing CIA, has not been investigated in children.

Methodology: We conducted a prospective, non-randomized trial including children ≤ 15 years with intermediate-(IR) or high-risk (HR) acute lymphoblastic leukemia (ALL) undergoing induction chemotherapy. Participants were sequentially assigned to either SC or non-cooling group. SC was done using a pre-cooled Elasto-Gel cap (scalp temperature maintained $< 25^{\circ}\text{C}$), from 30 minutes before chemotherapy infusion (daunorubicin + vincristine) to 30 minutes after. Primary outcome was successful hair preservation (HP), defined as NCI-CTCAEv5.0 alopecia grade 1 at end of induction (EOI). Secondary outcomes included changes in scalp ultrasonographic and scanning electron microscopic parameters (SEM) along with trichoscopy and trichogram findings.

Results: Twenty-two children with a median age of 72 months (IQR= 60-129) were enrolled (13 children in IR- ALL and 9 children in HR-ALL). One child in SC and two in a non-cooling group out of 11 in each died before EOI. Successful HP was achieved in 9/10 in SC group versus 2/9 in non-cooling group ($p=0.005$).

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Amongst sonographic parameters, there was significantly lesser decrease in dermal thickness in the SC group (-0.03mm vs. -0.3mm, $p=0.049$). Amongst SEM parameters, there was significantly better preservation of shaft diameter (-7.9 μ m vs. -21.6 μ m, $p=0.005$) and cuticular scale density (-3.5 scales/100 μ m vs. -12 scales/100 μ m, $p=0.0004$) in SC group. Trichoscopic and trichogram findings associated with CIA were more pronounced in the non-cooling group. No subjects reported headaches or dizziness during SC.

Conclusion: SC was associated with a higher likelihood of successful HP in children with ALL undergoing induction chemotherapy. Scalp cooling was safe and well-tolerated in children with cancer. Further studies investigating the long-term safety outcomes of scalp cooling are needed.